United States Department of Agriculture | Forest Service | R-4

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BOISE FIELD OFFICE

Reply to: 3420

Date: November 4, 1986

Subject: Biological Evaluation of Spruce Beetle in Big Cottonwood Canyon, Salt Lake RD, Wasatch-Cache NF

To: Forest Supervisor, Wasatch-Cache NF

On June 17, David Holland, Entomologist, Borys Tkacz, Plant Pathologist, and John Kalifarski, Plant Pathologist, met with John Hoagland, Forester, Salt Lake RD, and personnel from Brighton Ski Corporation to examine avalanche damage within the Brighton Ski Area, Big Cottonwood Canyon, Utah. Unusual snow conditions produced numerous avalanches throughout the Wasatch Range during the 1985-86 winter. The Clayton Peak Slide passed through an overmature Englemann spruce/subalpine fir stand, causing extensive knock down.

The preliminary survey revealed a potential for rapid spruce beetle population build-up in the downed host material. An increase of spruce beetle in the down material created conditions for beetle attack in adjacent standing material. A Biological Evaluation needed to be done to determine the extent of the problem and provide conclusive recommendations.

The group also met with Mike Wolf, Operations Manager, Solitude Ski Corporation, to look at the cutting of a new ski run near the Inspiration Ski Lift. The cutting crews started working before all the snow had melted, leaving some high stumps that needed to be cut flush to the ground to prevent spruce beetle population build-ups. Spruce beetle was attacking some of the high spruce stumps. The high stumps should be left through the flight period, during the summer to attract the beetles. Subsequent cutting of these stumps, and other large slash, into short bolts will prevent emergence of the brood in the summer of 1988.

Brighton and Solitude officials are managing the spruce slash effectively by limbing, bucking, and removing the material from ski runs. These practices have effectively limited the insect problem in the past.

On July 9-11, John Anhold, Entomologist, Borys Tkacz, John Kalifarski, and Ann Keysor, Biological Technician, returned to Big Cottonwood Canyon where they met with John Hoagland and Solitude officials to examine the Honeycomb Peak Slide. A survey of the damaged material was completed and recommendations were similar to those for the Brighton slide.

Two other slides in the Days Fork Area, Big Cottonwood Canyon, were of concern to John Hoagland and were examined.

A determination of live spruce trees at risk to spruce beetle can be made, but only after the progeny has developed one year of the two year life cycle. At that time, a population survey can be done and potential tree mortality determined.

The enclosed Biological Evaluation contains the results, alternatives, and recommendations for the slide areas examined in the the Big Cottonwood Canyon.

/s/ David G. Holland

DAVID G. HOLLAND
Acting Group Leader
State and Private Forestry

Enclosures

cc: (w/encl.)
Salt Lake RD
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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

FOREST PEST MANAGEMENT

STATE & PRIVATE FORESTRY

INTERMOUNTAIN REGION 4

4320
Report No. R4-86-16
September 1986

Spruce Beetle Survey in Big Cottonwood Canyon Salt Lake Ranger District Wasatch-Cache National Forest

1985

by
John Anhold, Entomologist

INTRODUCTION

The spruce beetle, Dendroctonus rufipennis (Kirby), is a serious pest of Engelmann spruce, Picea engelmannii Parry, in the Rocky Mountains. Spruce beetle outbreaks usually originate in windthrown timber, although avalanches may also increase beetle populations, providing host material in the preferred and more advantageous down position. Avalanches leave branches, parts of trees, and trees piled on top of one another creating conditions similar to that of windfall.

In the winter of 1985-86, unusual snow conditions produced destructive avalanches throughout the Wasatch Range. Consequently, new slide paths were created with damaged and downed vegetation. On the Salt Lake District several new slide paths were formed with some of them destroying valuable timber. In areas of spruce, this has set the stage for rapid increases in spruce beetle populations. The purpose of this evaluation is to (1) describe the current situation, including tree losses, (2) discuss projected losses in the future, and, (3) provide recommendations for minimizing future losses to the spruce beetle.

GENERAL INFORMATION

Life History and Evidence of Infestation. Schmid and Frye (1977) and Massey and Wygant (1954) describe the spruce beetle life cycle and behavior in detail. Briefly, Dendroctonus rufipennis has a 2-year life cycle, although 1- and 3-year life cycles have been described. The adults emerge from May through early July and attack host material soon after emergence. Egg gallery construction and oviposition continue through the summer. By mid-October,

nearly all of the eggs have hatched and immature larvae overwinter. During late spring-early summer (the year following attack) the larvae pupate and transform into adults. The second winter is passed in the adult stage, and the following summer adults emerge to attack new host material (Figure 1).

Trees infested by the spruce beetle are often difficult to detect. The needles turn a greenish yellow and begin to fall the year following attack. At times needles may remain green until the fall of the second year (Belluschi and Johnson 1969). Pitch tubes are not always present, as a result, first-year attacks are sometimes only detected by the presence of reddish brown boring dust around the base of the tree. However, boring dust is not always noticeable and the bole must be examined for emergence or ventilation holes (Furniss and Caroline 1977).

Spruce beetles generally prefer to attack green windthrown or other recently downed spruce. As a result, endemic beetle populations are always present, breeding in scattered down material in the spruce-fir forest type. Outbreaks are often caused by beetle populations building up in windthrown trees or logging debris, and spreading to standing trees. Downed spruce offers two obvious advantages for survival: (1) during the winter months windthrown trees are usually covered by snow which provides an insulating cover, preventing low temperatures from killing the brood and (2) snow also prevents woodpeckers, the most important predator of the beetle, from consuming the brood. Under favorable conditions, outbreaks may persist until suitable host material is depleted. The collapse of the population can occur after unfavorable climatic conditions, principally extreme cold.

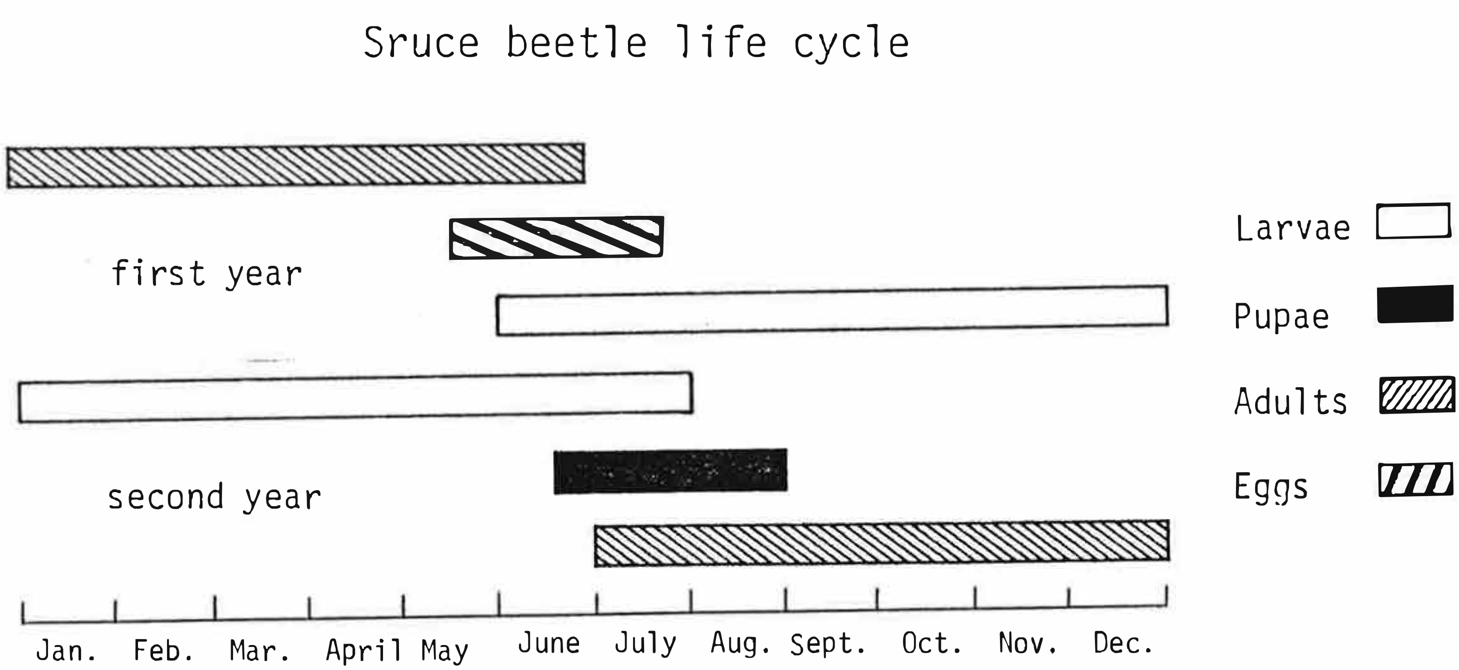

Figure 1. General two year life cycle for <u>Dendroctonus rufipennis</u>, spruce beetle.

<u>Location and Extent of the Current Population.</u> Two areas of concern have been detected by John Hoagland, Forester, Salt Lake RD, both within the boundaries of winter ski areas, Brighton and Solitude. The problem areas were created when heavy snow fall with the right climatic conditions caused avalanches. At Brighton an avalanche originated from the west side of Clayton Peak, traveling in a northwesterly direction into a stand of Engelmann spruce, the Clayton Peak Slide (Figure 2). At Solitude, a slide of similar magnitude occurred off of the Honeycomb Cliffs, traveling in a northeasterly direction. The Honeycomb slide also traveled through spruce, however, the stand was much smaller.

In both areas, ski runs were either partially or totally blocked with down trees and debris. Also of concern are the potential long-term effects on the watershed, if a large spruce beetle infestation occurred in the area. Aesthetic, wildlife, and timber values could also be dramatically impacted.

Also, two slide areas up the Days Fork Trail were examined for increased spruce beetle activity. In both areas, the composition of spruce was so low, 5 - 7%, that no beetle population expansion would occur.

METHODS

A 100 percent cruise was done in both slide areas to determine number and volume of Engelmann spruce suitable for attack and breeding. Each downed spruce was carefully checked for signs of new attacks by both Engelmann spruce beetle and Dryocoetes species. Generally the spruce beetle was found on the shady underside, while the Dryocoetes species bored in the upper regions of the down tree. Diameters were taken at approximately 4.5 feet and height to a 4 inch top so volume estimates could be calculated. Also, these measurements could later be used in determining beetle densities.

A systematic variable plot cruise was used to estimate tree risk levels and potential breeding material in adjacent stands. Variable radius plots (BAF 20) were established every three chains along a 12 chain transect. All trees within each plot were examined and the following information was recorded: tree species, diameter at breast height (DBH), general condition (live or dead) and presence of insects.

RESULTS

The Clayton Peak slide downed approximately 98 spruce, with an average diameter of 16.5 inches and an estimated 18,463 board feet of volume. At the time of examination, July 10, adult spruce beetles were just entering the down material. Spruce beetle attacks were detected on 100 percent of the damaged spruce with the majority of the spruce also hit by Dryocoetes.

The adjacent host stand conditions showed high risk to future attacks (Schmid and Frye 1976) Table 1. Average quadratic mean diameter (QMD) of live spruce is 20.3. Stand basal area ranged from 160 to 220 with an average of 185 square feet per acre. There are 111 trees per acre (TPA) with 68 percent being Engelmann spruce with the remaining 32 percent represented by subalpine fir, <u>Abies lasiocarpa.</u>

The Honeycomb slide downed 59 spruce trees. Approximately 1,731 board feet of timber was accounted for with an average diameter of 10.8. There was also 100 percent attack on damaged host material for both spruce beetle and Dryocoetes.

The surrounding stand was rated as medium to high susceptibility to beetle attack (Table 2). Average QMD of live spruce is 20.4. Stand basal area ranged from 140 to 200, with an average of 175. There are 288 TPA, with 51 percent of the stand being Engelmann spruce and the remaining primarily subalpine fir.

DISCUSSION

Spruce beetle populations develop to high levels rapidly in down material, and may become a serious problem in adjacent standing trees. Stand data describes the surrounding forest as overmature spruce and subalpine fir. The stand has the necessary attributes for high susceptibility to spruce beetle attack. Highly susceptible stands are characterized by an average DBH of greater than 16 inches, basal area over 150 square feet, 65 percent or greater spruce in the canopy, and a physiographic location with a high site index.

To determine expected tree losses in adjacent standing timber due to down infested material, some measure of beetle density must be determined. Schmid (1981) developed a sampling scheme which measures beetle densities and translates them into tree losses. By sampling various areas of downed trees, i.e., top, lateral, and bottom, a mean number of beetles per square foot of bark can be determined. Using the number of downed trees and average infested bark area per tree, a number of potential beetles available for attacking standing trees can be calculated.

However, sampling for an infestation trend is confined to two periods in the life cycle. The first of these is in late June of the year following attack by the beetles. At this time the progeny are in the larval stage. The second is in late August or early September of the same year. At this time most of the progeny are callow adults. This latter sampling must be done before the adult beetles emerge for hibernation.

Sampling in June is done to determine whether control work is needed immediately. For this purpose only two categories are necessary: (1) not treatable--in this case the infestation is expected to decrease, and (2) treatable--in this case the infestation is expected to remain static or increase.

Sampling in late August or early September is done for a somewhat different purpose. It is usually too late to carry out chemical control work or logging on the particular infested trees, but not too late to use trap trees. The evaluation at this time is for predicting the seriousness of the infestation in terms of the number of newly infested trees that will result from the flight of beetles in the following spring and summer.

However, by doing a risk evaluation of the area, an approximate determination of the future damages can be ascertained. This early reconnaissance, as here reported, can be of high value to private landowners and resort areas which may have need for more immediate action.

The results of our surveys indicated that spruce beetle populations will move to adjacent high risk stands, where heavy losses can be expected in the larger diameter trees.

ALTERNATIVES

Schmid and Frye (1977) mention a variety of suppression alternatives, however, the following alternatives are more applicable to the situation in the Big Cottonwood area.

1. No action. This alternative would allow the infestation to continue and accept the losses incurred until the infestation collapses naturally. Estimates of losses can be approximated through population surveys.

2. Direct suppression. This alternative would involve individual tree treatment. This treatment could be through removal of infested trees, treating them with a chemical insecticide, or by felling and burning. Individual tree treatment is often expensive and effective only in small infestations. Chemically treated trees could be salvaged at a later date.

Also, the use of solar heat has been successful in reducing beetle populations in down material. Mitchell and Schmid (1972) showed 92 percent beetle mortality in logs limbed and bucked into four foot sections. However, the log must be turned by mid-summer to insure even heat distribution (Werner and Holsten 1983). For larger timber, bucking to 18 inch lengths will insure sufficient drying.

3. Sanitation logging. In this alternative, adjacent susceptible green trees would be removed from the stand on a selective basis. This would remove the large diameter trees and reduce the basal area of the stand by changing the green stand structure. This alternative would not be effective by itself in an already infested stand; however, sanitation logging could be used to reduce the susceptibility of an uninfested stand.

4. Salvage logging. Both currently infested trees and dead trees would be removed. This alternative would utilize the timber resource, as well as suppress the infestation. However, in large areas of infestation, this action may not be practical. This type of logging would not change factors in the stand causing the outbreak.

5. Sanitation/salvage logging. This alternative combines the removal of dead and infested trees, and the susceptible uninfested trees in a stand. This would allow utilization of the timber resource and change the stand structure to reduce the susceptibility of the stand. In extensive areas of infestations, this alternative may not be practical.

RECOMMENDATIONS

Short-term action. The action taken in the next couple years is the most critical from the standpoint of controlling the spruce beetle population. Direct suppression, in terms of felling, piling and burning, is most suitable in these areas. If burning is not permissible, either the bark should be removed from logs or they should be bucked to 18 inches to insure the beetles do not complete development. Simply limbing logs may not allow the bolts to dry sufficiently for brood mortality.

The use of insecticide can be most effective in situations as this, however, given the watershed values at risk, this option is limited.

Salvage or a sanitation/salvage logging operation may be considered. This would make use of the resource and, in the case of sanitation efforts, reduce the susceptibility level of adjacent stands.

A population density study could be done the following year after the attack (summer 1987) if there was any question on the extent of the tree losses expected.

Long-term action. The potential for future spruce beetle infestations will remain high unless management practices are undertaken to modify the spruce-fir stands. Hazard ratings should be done to determine the susceptibility of uninfested stands and priorities established on the stands. Managing these stands would involve sanitation logging to convert stands to a less susceptible condition by removing large diameter, overmature trees and reducing the basal area of the stand. If blowdown or avalanche damage occurs, the infested material should be treated or removed promptly.

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Table 1. Summary data from the Clayton Peak Slide.

Variable plot #	%ES	%SAF	*TPA	*ES QMD	*BA	Risk Rating	Down Material #	*BF Vol.
1	64	36	114	21.3	220			
2	75	25	87	22.5	160			
3	78	22	118	20.3	180			
4	56	44	125	17.1	180			
	68	32	111	20.3	185	11	98	18,463

Table 2. Summary data from the Honeycomb Peak Slide.

Variable plot #	%ES	%SAF	TPA	ES QMD	BA	Risk Rating	Down Material #	BF Vol.
1	75	25	172	21.8	160			
2	40	60	292	19.0	200			
3	40	60	466	24.0	200			
4	50	50	233	16.9	140			
	51	49	288	20.4	175	10	59	1,731

*TPA = trees per acre.
*ES QMD = englemann spruce's quadratic mean diameter.
*BA = basal area in square feet.
*BF Vol. = board foot volume in cubic feet.

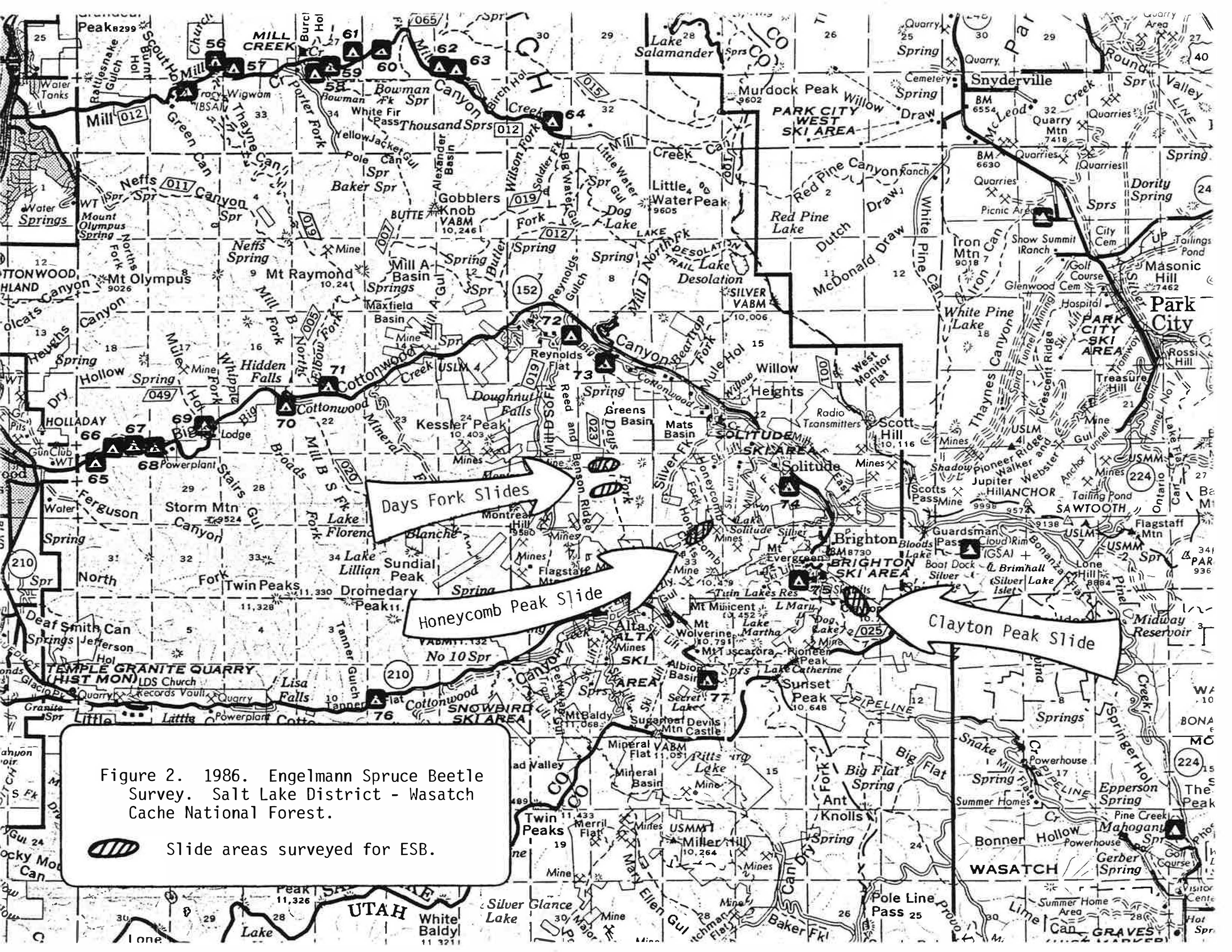

Figure 2. 1986. Engelmann Spruce Beetle Survey. Salt Lake District - Wasatch Cache National Forest.

Slide areas surveyed for ESB.